LIVERMORE LAB
REPORT

A weekly review of scientific and technological achievements from Lawrence Livermore National Laboratory, April 2-5, 2013.

NOVA A BUNCH OF CARBON COUNTING

NOVA host and tech guru David Pogue (right) interviews LLNL's Tom Brown.

Living things constantly replenish the carbon in their bodies. When a living organism dies, the carbon 14 in its body decays at a steady rate and the atoms can be counted.

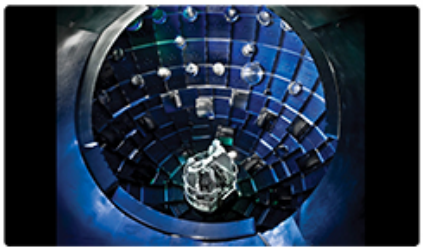
Tom Brown, who works at the Lab's Center for Accelerator Mass Spectrometry, can carbon date samples as old as 40,000 years ago. He recently dated a dead tree sample taken from the Mono Lake region in California.

"Intact wood is very good for carbon dating," Brown said. "It retains the carbon when that material died."

He put the sample in the Lab's accelerator where the carbon 14 atoms are counted. According to his count, the tree died 150 years ago.

To see more, go to the video.

HOPE AS BRIGHT AT THE SUN



Technicians work inside the target chamber of the National Ignition Facility.

When the world's most powerful laser, housed at the Lawrence Livermore National Laboratory, zaps a target, it's eerily silent. If you're close enough to know the exact moment the system fires, chances are you're standing in a darkened control room, watching a silent countdown. The only hint that something has occurred is a timer that hits zero and immediately starts counting up again.

Hidden from view is an experiment of staggering proportions and precision: 192 laser beams streaming through halls that span the length of football fields, steadily gaining in strength before they finally converge within millimeters of one another, triggering the implosion of a peppercorn-size capsule.

The lasers of the National Ignition Facility (NIF) have already created the intense pressures and temperatures needed to get atoms of hydrogen to fuse. But NIF is trying to achieve a far more challenging goal, one that countless researchers have sought for decades. NIF's aim is not just fusion (the same energy that powers the sun and stars) but fusion's equivalent of a chain reaction, a self-sustaining "burn" capable of producing more energy than is needed to get the process started in the first place.

To read more, go to *IEEE Spectrum*.

IN HER ELEMENT

Dawn Shaughnessy

When it comes to elemental science, Lawrence Livermore chemist Dawn Shaughnessy is in a field of her own.

She is the project leader of the LLNL heavy element program, who along with her team, has discovered six new elements on the periodic table.

From a young age, Shaughnessy always has been interested in science.

"Throughout school I was very engaged in all of my science classes and I knew that if I pursued a career in one of the science, technology, engineering or math (STEM) areas, I would always feel challenged and would get to do research on exciting problems," she said. " I enjoy being challenged every day and working in STEM means there is always a new issue or problem to solve, and I always feel satisfied that my work is helping to understand the world around us. Science is an area where I truly feel proud about the work I do every day."

To read more, go to energy.gov.

ASHEVILLE'S HOMEPAGE CITIZEN-TIMES.com A GANNETT COMPANY

THE METHANE AHEAD IS FRIGHTENING

The blue flame of clean burning methane. Photo courtesy of Fotolia/Pakhnyushchyy .

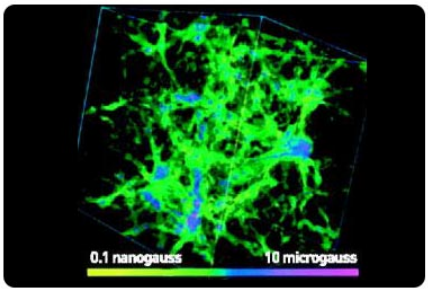
The Arctic is in a state of compression produced by the weight of its mass. As warming begins to take place, it will decay, but, deprived of oxygen by its compressed condition, the product of that decay will be methane, not CO2. Given the huge amount of organic matter involved, the process of decay can be expected to produce quantities of methane in the trillions of tons.

Methane is far more potent as a greenhouse gas than CO2, and both American and Russian investigators have detected massive amounts being belched into the atmosphere from the frozen tundra and the ocean bed. Lawrence Livermore National Laboratory scientists estimate that the release of as little as 1 percent of this methane would have a warming effect approaching that being produced by all of the CO2 that has been pumped into the atmosphere by human activity since the start of the Industrial Revolution.

The warming Arctic temperatures will determine how much methane is released into the atmosphere. Newly developed methods of measuring its thickness reveal that it also has diminished by half. Hence, the total volume of the Arctic's sea ice has been reduced by three-quarters in little more than three decades.

To read more, go to *Citizen-Times*.

FRONTLINE CALM AMIDST THE CHAOS



Self-organization is evident, as in this simulated magnetic field in a cluster of galaxies.

One of the enduring mysteries of astrophysics is how highly organized structures such as vast magnetic fields stretching out for millions of light years can emerge from the frenetic motion of the superhot ions and electrons that constitute a plasma.

Scientists at Lawrence Livermore National Laboratory have discovered that streaming plasmas created by powerful lasers appear to give rise to "self-organized" electromagnetic fields similar to those found throughout the universe, such as those that emanate from young stars or supernovae.

Using the OMEGA laser at the University of Rochester, the team discovered that supersonic plasmas colliding head-on generated large, stable "structures" of electric or magnetic fields by a mechanism yet to be explained.

"What we observed was completely unexpected," says Hye-Sook Park, a physicist and the leader of the team. "The plasmas we created moved so quickly that we expected them to freely stream past each other without causing the formation of any regular or long-lasting electric or magnetic fields."

To read more, go to *Frontline*.

LLNL applies and advances science and technology to help ensure national security and global stability. Through multi-disciplinary research and development, with particular expertise in high-energy-density physics, laser science, high-performance computing and science/engineering at the nanometer/subpicosecond scale, LLNL innovations improve security, meet energy and environmental needs and strengthen U.S. economic competitiveness. The Laboratory also partners with other research institutions, universities and industry to bring the full weight of the nation's science and technology community to bear on solving problems of national importance. To send input to the *Livermore Lab Report*, send e-mail.